INSTITUTO DE BIOLOGIA MOLECULAR E CELULAR
INSTITUTE FOR MOLECULAR AND CELL BIOLOGY

BOLSA DE INVESTIGAÇÃO (M/F)

Referência: PTDC/EBB-EBI/099662/2008

Título do Projecto: "Exploitation of cyanobacterial exopolysaccharides (EPS) for heavy metals bioremediation"

Código interno: PR041704

Está aberto concurso para recrutamento de um(a) bolseiro(a) de Investigação para colaborar no projecto acima referido, financiado pelo programa COMPETE - Programa Operacional Factores de Competitividade na sua componente FEDER e pelo orçamento da Fundação para a Ciência e a Tecnologia na sua componente OE.

A bolsa, em regime de exclusividade, terá a duração de 1 ano eventualmente renovável, com início previsto em 1 de Maio de 2010.

O valor mensal da bolsa será de € 745,00, pago por transferência bancária (preferencialmente).

Local de trabalho: Unidade de Investigação de Microbiologia Celular Aplicada, IBMC, Porto.

Programa de trabalho: (ver sumário em anexo).

Perfil pretendido:
Os candidatos devem possuir licenciatura ou grau superior na área das Ciências Biológicas, Bioquímica ou afins. Dá-se preferência a candidatos com experiência na área.

O prazo para recepção de candidaturas decorre de 7 a 21 de Abril de 2010.
As propostas deverão incluir CV e uma carta de referência e ser enviadas por correio electrónico para o e-mail candidaturas@ibmc.up.pt com indicação do código interno (PR041704).

Após avaliação do CV, os candidatos pré-seleccionados poderão ser chamados para entrevista.

A contratação será regida pelo estipulado na legislação em vigor relativamente ao Estatuto de Bolseiro de Investigação Cientifica, nomeadamente a Lei 40/2004, de 18 Agosto, e o Regulamento de Bolsas de Investigação Científica do IBMC (www.ibmc.up.pt/fellowships.php).

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Exploitation of cyanobacterial exopolysaccharides (EPS) for heavy metals bioremediation
PTDC/EBB-EBI/099662/2008

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Project Summary:

Heavy metals enter the environment trough a variety of human activities being one of the most widespread causes of pollution. Their continuous accumulation in water bodies and soils constitutes a serious hazard both to the environment and to human health. Currently, chemical/physicochemical methods are used to remove metals from polluted waters, but they enclose disadvantages like low efficiency at low metal concentrations, low selectivity, and difficulties in the recover of the metal removed. Therefore, alternative methods have emerged such as the use of microorganisms producing extracellular negatively charged polysaccharides. This technology presents advantages such as the use of natural and renewable sources, reduced costs and rapid kinetics of metal removal, the ability to remove metallic ions present at low concentrations, the possibility to treat contaminated waters simultaneously with several different metal ions, and the possibility of recovering valuable metals from the biosorbent. The overall efficiency of the process is related to the interactions among the negatively charged binding sites of the polysaccharidic layer surrounding the cells and the positive charge of the metal ions in solution. Thus, the amount of metal removed per biomass unit depends on the exopolysaccharides (EPS)-producing microorganism utilized, on the characteristics of the metal, and of the matrix where the ions are solubilised. In this context, EPS-producing cyanobacteria are promising candidates due to the peculiar characteristics of their polysaccharidic envelopes, and due to the fact that they have the simplest nutritional requirements making their culture easy and inexpensive. Cyanobacterial EPS frequently contain two different uronic acids, building a polymer particularly rich in negatively charged groups, they possess a larger number of different monosaccharides, which increases the number of possible conformations of the polymer, and they contain sulfate groups, a unique feature among prokaryotes. Despite these theoretical advantages, the efficient use of EPS-producing cyanobacteria (or the isolated polymers) for the removal of heavy metals from contaminated waters depends on the comprehensive knowledge of the pathways utilized by these organisms for their synthesis and export, and on the factors regulating these processes. As a consequence of their complexity, the cyanobacterial EPS and the pathways leading to its production are less well characterized than those of other organisms. Therefore, the major aims of the project are: (i) identification/characterization of genes encoding proteins involved in the production of cyanobacterial EPS, and the identification of regulatory factors controlling its expression, (ii) screening the physiological conditions promoting these genes expression and (iii) optimization of the metal removal process at laboratory scale.
The unicellular cyanobacterium Cyanothece sp. CCY 0110 will be used as model organism, since several Cyanothece strains have their genomes fully sequenced, and a number of studies reported these organisms as strong EPS producers, as well as efficient removers of metal ions from aqueous solutions.
Moving from an in silico analysis of the available cyanobacterial genomes (already performed by our research group), genes encoding proteins putatively involved in EPS production/export will be characterized. Their transcriptional start points will be determined using 5´RACE, the promoter regions analyzed, and the predicted transcriptional units will be confirmed by RT-PCR. In addition, the putative transcriptional factors will be identified by protein/DNA affinity assays and electrophoretic mobility shift assays.
Moreover, the physiological conditions in which the genes encoding proteins involved in EPS production are particularly transcribed/expressed will be studied. For this purpose the cells will be cultured in conditions that are reported to influence EPS production, such as the presence/absence of combined N and S, different light regimens and temperatures. The levels of transcripts will be determined by Real-Time RT-PCR, and correlated to the amount of EPS produced. Concomitantly, the protein profiles of cells grown in different conditions will be evaluated by mass spectrometry. The combination of the transcriptomic and proteomic approaches will contribute to unveil the metabolic pathways of cyanobacterial EPS production.
The optimization of the metal removal process will be achieved by testing several aspects that will be important for future biotechnological applications, such as the efficiency of the biosorbent freely dispersed versus confined into dialysis tubings, the possibility of using the same biosorbent in several sorbing-desorbing cycles and in single- and multi-metal systems.
The data generated by this work will contribute to the knowledge on the biosynthetic pathways leading to the production/export of cyanobacterial exopolysaccharides, as well as for the future implementation of heavy metal removing systems based on cyanobacterial EPS.

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